Berkeley- Stanford CE&M Workshop.

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My Vision about the AEC business
I would like to work in a business that:
- can match the same productivity and profit margin as most other businesses
- work on internet time
- can respond to customers need for flexibility and dynamics without costly rework and time delays
- Is fast to implement new technologies and management styles
- Foster competent professionals with gut feeling for technique
- Believes that sharing competence and knowledge gives them a competing advantage
- Attracts young talented people

The AEC Work process
The AEC process can often be generalized as a process built by four different stages.

Pre Project planning - Design - Contracting - Facility Management
Each stages drive is to have as little communication and knowledge sharing as possible between each other. The business culture as a whole is based on the belief that by sharing data and knowledge you give up your strategic advantage. Every part in the process is more or less reluctant to drive technological progress and implementation of it. Everything is done when required.
When new technology do occur they are often badly implemented and not properly tested. This together with participants general lack of ability and interest to "roll with the punches" and adapt to changes makes the AEC business very slow.
One problem is the slow process of "competence gathering". It usually takes five years from when you start in the business to when you can run your own projects. How do we attract young people from other business that allows them to move a lot faster.
**This is symbolized in the figure below**
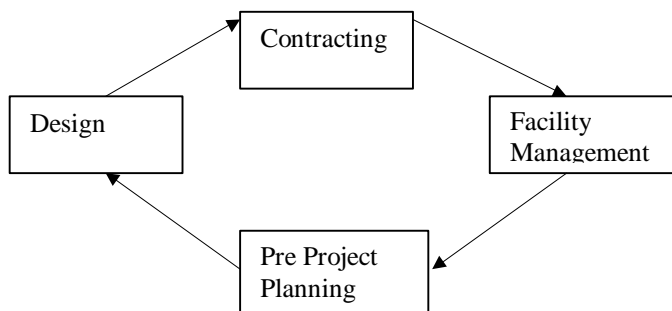
What we would like to do is use new technology to:
- Exchange data, knowledge, intention and experience.
- Fast reaction to customer needs and dynamics.
- Reuse of knowledge and information trough the whole process
- Retrieval of data, knowledge and intention to answer why questions.
This should not be applied in projects only but could be global.

Desired function to be able to react fast would be symbolized like
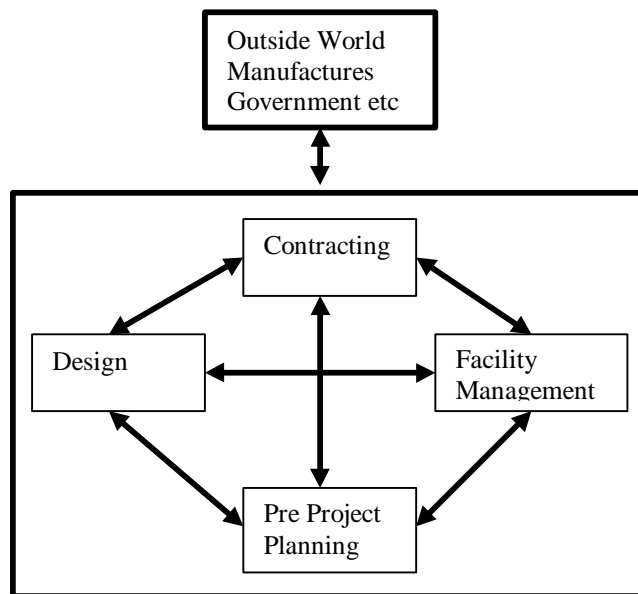
Enabling technologies - analysis tools and interchangeable data
Different Tools is often used in different occasions.
Our experience is often two kind of situations or methods.

**Heuristic method** requires highly flexible and easy tools.
Spreadsheet like Excel and 123 or Databases like Access is often used here. Focus here is on technical knowledge in the person doing the analysis. This method is often used to make the first aim at generic structures in the beginning of the project.
Quantitative method or simulation requires more stringent tools. We often use specific tools for specific tasks like energy simulation, cooling load, heat load, pressure drop calculations, cost calculation etc. These tools have little or no ability to communicate with other tools or standards and there is no way of recycle data trough the design process.
At Stanford I have come across a third situation or method - **symbolic modeling** that seems to be placed somewhere between heuristic methods and Quantitative methods. The models developed that I have seen is often highly flexible and highly powerful at a specific task area and they require a certain amount of data but not as much as simulation does. Symbolic modeling seems to be extremely well fitted in the complex world of AEC.
In any case most every tool are more or less isolated islands of data and the general idea is often that they should interact with or incorporate some kind of standard like IFC. In later years i personally have come to doubt the solution of one large complete information standard. Test that we have performed point more to some kind of model interchange standard. We do not exchange all data between all tools, we do not exchange some data at all. We only exchange "interface" data, this is data that is common or shared by different tools.
The figure below try to show amount of data required with different systems and amount of data that is common to the different methods or tools.
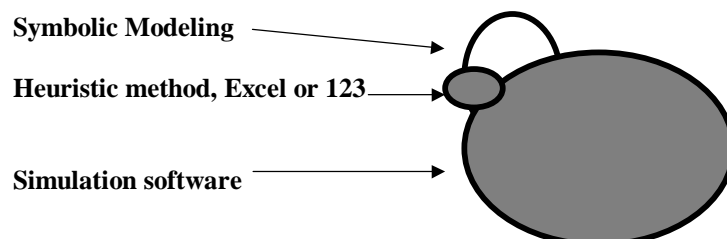
This leads to the following research areas:

Enabling technologies

We need more and deeper research about enabling technologies like some former Stanford projects and to make this accessible to the business. We also need to find new ways to share knowledge, intentions and experience.

Example
 - 4D cad as a general description model (great for capturing design intentions).
 - Interdisciplinary Communication Media (great for context communication)
 - Semantic Model Extension (great for knowledge communication & customer intention)
 - Intelligent Real Time Maintenance Manager (great for customer & design intention)
 - E-commerce (great for speed and economics and exchange context)
 - Collaborative technologies (great for putting the pieces together)
 - Project based learning lab (great for collaboration & speeding up competence gathering)
 - Tools that allow personal "competence gathering" and build up of experience
 etc

Business culture

We also need research about our business culture and how to change it.

Example
 - Why do we react the way we do regarding communication and information sharing?
 - Why is AEC people more opposed to new technology?
 - Why is AEC people more opposed to new business methods?
 - Why do we believe that sharing knowledge reduces our competitive advantage
 - How can we change the current business model
etc

Building physics

We also need research about building physics.

(Example is research in Sweden about freezing course in pipes. This project drastically changed the way we protect pipes from freeze. From complex and expensive to simple and cheap methods
or sick building research)

Example
 - How can we build fast, without negative consequences like sick buildings?
 - What combination of materials can be used in fast track projects.
etc

Tools integration or standardization

We would need research about integration:

Example
 - What requirement do we have for exchange binary models (whole or part) that include knowledge, intention and ability to communicate with different tools.
 - Should different tools or methods exchange relevant interface information or do we have better ways.
 - What does the future look like regarding data exchange standards
 - How do we integrate enabling technologies
 - How different tools can use enabling technologies to exchange context.
etc

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